

Prepared in cooperation with the Louisiana Department of Transportation and Development

Water Resources of Calcasieu Parish, Louisiana

Introduction

Information concerning the availability, use, and quality of water in Calcasieu Parish, Louisiana (fig. 1), is critical for proper water-resource management. The purpose of this fact sheet is to present information that can be used by water managers, parish residents, and others for stewardship of this vital resource. Information on the availability, past and current use, use trends, and water quality from groundwater and surface-water sources in the parish is presented. Previously published reports (see References Cited section) and data stored in the U.S. Geological Survey's National Water Information System (<http://dx.doi.org/10.5066/F7P55KJN>) are the primary sources of the information presented here.

In 2010, about 223.7 million gallons per day (Mgal/d) of water were withdrawn in Calcasieu Parish, including about

136.7 Mgal/d from surface-water sources and 87.0 Mgal/d from groundwater sources.¹ Withdrawals for industrial use accounted for the majority (156.5 Mgal/d) of total water withdrawn (tables 1–2). Other categories of use included public supply, power generation, rural domestic, livestock, rice irrigation, general irrigation, and aquaculture. Water-use data collected at 5-year intervals from 1960 to 2010 (fig. 2) indicated that water withdrawals peaked in 1970 at about 1,020 Mgal/d. The generally downward trend in water withdrawals from 1960 to 2010 is largely attributable to reductions in withdrawals for industrial use and rice irrigation.

¹Water-withdrawal data are based on estimated or reported site-specific data and aggregated data, which are distributed to sources. For a full description of water-use estimate methodology, see "Data Collection" in Sargent (2011). Tabulation of numbers in text and tables may result in different totals because of rounding; nonrounded numbers are used for calculation of totals.

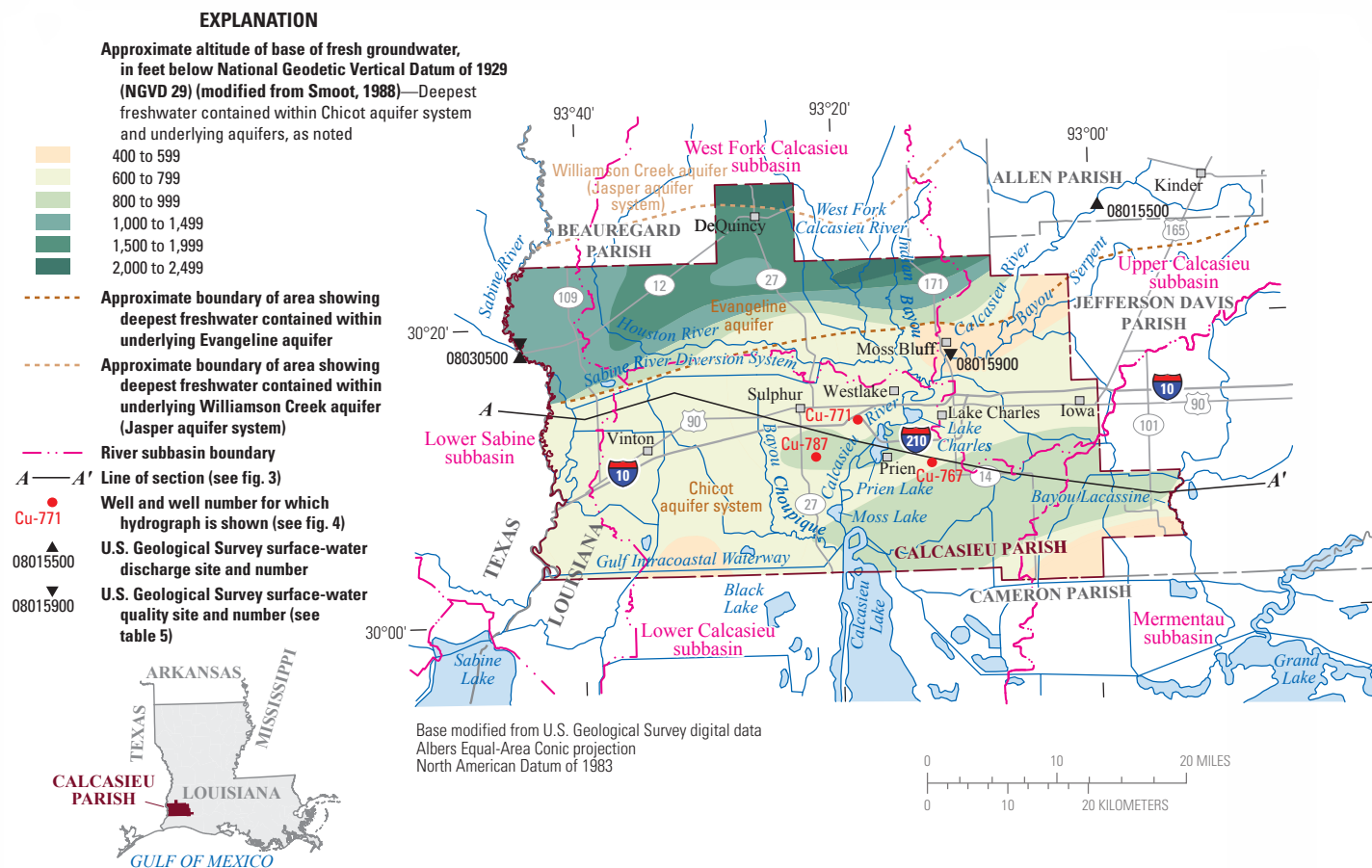


Figure 1. Location of study area, Calcasieu Parish, Louisiana.

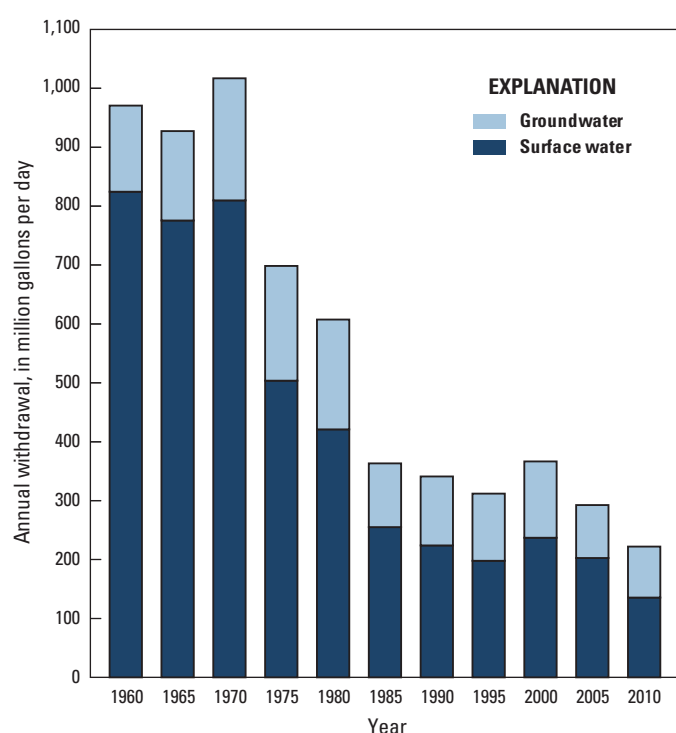
Table 1. Groundwater withdrawals, in million gallons per day, by source and use category in Calcasieu Parish, Louisiana, 2010 (B.P. Sargent, U.S. Geological Survey, written commun., 2015).

[<, less than]

Use category	Chicot aquifer system					Evangeline aquifer	Total by use
	"200-foot" and upper sand	"500-foot" sand	"700-foot" and lower sand	Undifferentiated sand	Shallow sand		
Public supply	1.19	21.62	2.10	0.04	0.00	0.79	25.73
Industrial	1.16	39.35	<0.01	0.72	0.00	0.00	41.23
Power generation	0.00	6.46	0.00	0.00	0.00	0.00	6.46
Rural domestic	1.56	0.53	0.00	0.02	0.11	0.00	2.23
Livestock	0.10	0.03	0.01	0.04	0.01	0.00	0.20
Rice irrigation	3.71	2.29	0.63	0.95	0.32	0.00	7.90
General irrigation	0.18	0.11	0.02	0.00	0.03	0.00	0.34
Aquaculture	0.58	0.58	0.58	0.00	1.16	0.00	2.90
Total by source	8.49	70.97	3.35	1.77	1.63	0.79	87.00

Table 2. Surface-water withdrawals, in million gallons per day, by source and use category in Calcasieu Parish, Louisiana, 2010 (B.P. Sargent, U.S. Geological Survey, written commun., 2015).

Use category	Calcasieu River	Gulf Intracoastal Waterway	Sabine River Diversion System	Miscellaneous streams	Total by use
Public supply	0.00	0.00	0.50	0.00	0.50
Industrial	76.17	0.01	39.12	0.00	115.30
Power generation	0.05	0.00	14.46	0.00	14.51
Livestock	0.00	0.00	0.00	0.30	0.30
Rice irrigation	0.00	0.00	0.00	3.77	3.77
Aquaculture	0.00	0.00	0.00	2.34	2.34
Total by source	76.22	0.01	54.07	6.42	136.72



Groundwater Resources

Fresh groundwater (water with a chloride concentration of 250 milligrams per liter [mg/L] or less) is available in Calcasieu Parish in several different aquifers to varying depths, depending on location. The base of freshwater in Calcasieu Parish ranges from about 400 feet (ft) below the National Geodetic Vertical Datum of 1929 (NGVD 29) to almost 2,500 ft below NGVD 29. The deepest freshwater is north of DeQuincy within the Williamson Creek aquifer. In the rest of the roughly northern quarter of the parish, the base is present at depths from about 700 to 2,000 ft or more below NGVD 29 within the Evangeline aquifer. In the southern three-fourths of the parish, the base of freshwater ranges in depth from about 500 to 800 ft below NGVD 29 and is within the Chicot aquifer system (fig. 1; Smoot, 1988).

The Chicot Aquifer System

The Chicot aquifer system is an important regional aquifer system underlying most of southwestern Louisiana. The aquifer system crops out and receives recharge in parishes to the north and northeast of Calcasieu Parish where the aquifer system is largely composed of one, major, undifferentiated sand. The undifferentiated sand thickens and deepens to the south and, near the northern border of Calcasieu Parish (fig. 1), becomes subdivided into a complex series of sand layers by clay confining layers. West of about the

Figure 2. Water withdrawals in Calcasieu Parish, Louisiana, 1960–2010 (Sargent, 2011).

longitude of the town of Iowa (fig. 1), these divisions consist of the “200-foot,” “500-foot,” and “700-foot” sands of the Lake Charles area (fig. 3). East of this longitude, these divisions consist of the Chicot aquifer upper and lower sands, which are hydraulically connected to the “200-foot” and “700-foot” sands, respectively (fig. 3).

A surficial confining layer of clay restricts infiltration of precipitation into the groundwater system throughout the parish. The surficial confining layer thickness ranges from 40 ft in small areas in northwestern and northeastern Calcasieu Parish to 280 ft in the south-central part of the parish (Sargent, 2004). Within the surficial confining clay are scattered sand streaks, sand lenses, and sand layers collectively named the “shallow sand unit of the Chicot aquifer system.”

The primary aquifers in the parish are the “200-foot,” “500-foot,” and “700-foot” sands (table 1), and these aquifers share similar characteristics but are present at varying depths. The “200-foot” sand generally grades from fine to medium sand at the top to a coarse sand or gravel at the base (Harder, 1960). The top of the sand is present at depths of zero to 50 ft above NGVD 29 near the northeastern corner of the parish and greater than 300 ft below NGVD 29 in the southwestern corner of the parish (Harder, 1960). The “500-foot” sand generally grades from fine sand at the top to coarse sand and gravel near the base (Harder, 1960). The top of the “500-foot” sand is present at less than 400 ft below NGVD 29 in northern areas of the parish and reaches over 600 ft below NGVD 29 in the southeastern corner of the parish (Nyman, 1984). The base of the “500-foot” sand ranges from greater than 400 ft below NGVD 29 in the northern part of the parish to greater than 800 ft below NGVD 29 in the southeastern corner of the parish (Nyman, 1989). The “700-foot” sand is generally tan to grayish and grades from fine sand at the top to coarse sand at the base (Harder, 1960). The top of the “700-foot” sand is present at depths of less than 400 ft below NGVD 29 in the northern part of the parish and reaches depths exceeding 800 ft below NGVD 29 in the southeastern corner of the parish. The base of the lower sand and “700-foot” sand ranges from greater than 400 ft in the northern tip of the parish to greater than 1,000 ft in the southeastern corner of the parish (Nyman, 1989). In 2015, more than 4900 active wells were screened in Chicot aquifer system in Calcasieu Parish, with most of them being screened in these three primary aquifers from depths of 13 to 849 ft, with yields of up to 5,471 gallons per minute (Louisiana Department of Natural Resources, written commun., 2015) (table 3).

Water levels in wells in all three sands in Calcasieu Parish showed similar spatial and temporal patterns. In 2011–12, water levels in wells screened in the “200-foot,” “500-foot,” and “700-foot” sands in Calcasieu Parish ranged from highs of approximately 7.6 ft above, 2.4 ft below, and 14.1 ft below NGVD 29, respectively, to lows of 49.9 ft below, 79.6 ft below, and 69.6 ft below NGVD 29, respectively (U.S. Geological Survey, 2016a). Spatially, water levels in wells in all three sands were lowest near the Calcasieu River in the Lake Charles metropolitan area, corresponding well to the documented movement of groundwater toward this area (Nyman, 1984; Lovelace, 1998). Water levels in wells have varied in similar ways over time and have risen in general by as much as 20 ft since the 1970s (fig. 4), because of decreased pumping.

Groundwater Quality

Freshwater samples collected from 111 wells screened in the “200-foot” sand, 239 wells screened in the “500-foot” sand, and 63 wells screened in the “700-foot” sand had median hardness values in the moderately hard range.² Over 90 percent of samples in each aquifer did not exceed the U.S. Environmental Protection Agency’s Secondary Maximum Contaminant Levels (SMCLs)³ for pH. Over 80 percent of samples in each aquifer did not exceed the SMCL for dissolved-solids concentrations. Median values for iron concentrations were below the SMCL in the “200-foot” sand and greatly exceeded the SMCL in the “500-foot” and “700-foot” sands (table 4).

Saltwater (water with a chloride concentration greater than 250 mg/L) is present in both local and widespread areas within the Chicot aquifer system in Calcasieu Parish. At the base of the “200-foot” sand and in the upper sand, saltwater is present along most of the southern parish boundary, in the southeastern corner of the parish, and in a localized area near Iowa. At the base of the

²Hardness ranges, expressed as milligrams per liter of calcium carbonate, are as follows: 0–60, soft; 61–120, moderately hard; 121–180, hard; greater than 180, very hard (Hem, 1985).

³The SMCLs are nonenforceable Federal guidelines regarding cosmetic effects (such as tooth or skin discoloration) or aesthetic effects (such as taste, odor, or color) of drinking water. At high concentrations or values, health implications as well as aesthetic degradation might exist. SMCLs were established as guidelines for the States by the U.S. Environmental Protection Agency (2016).

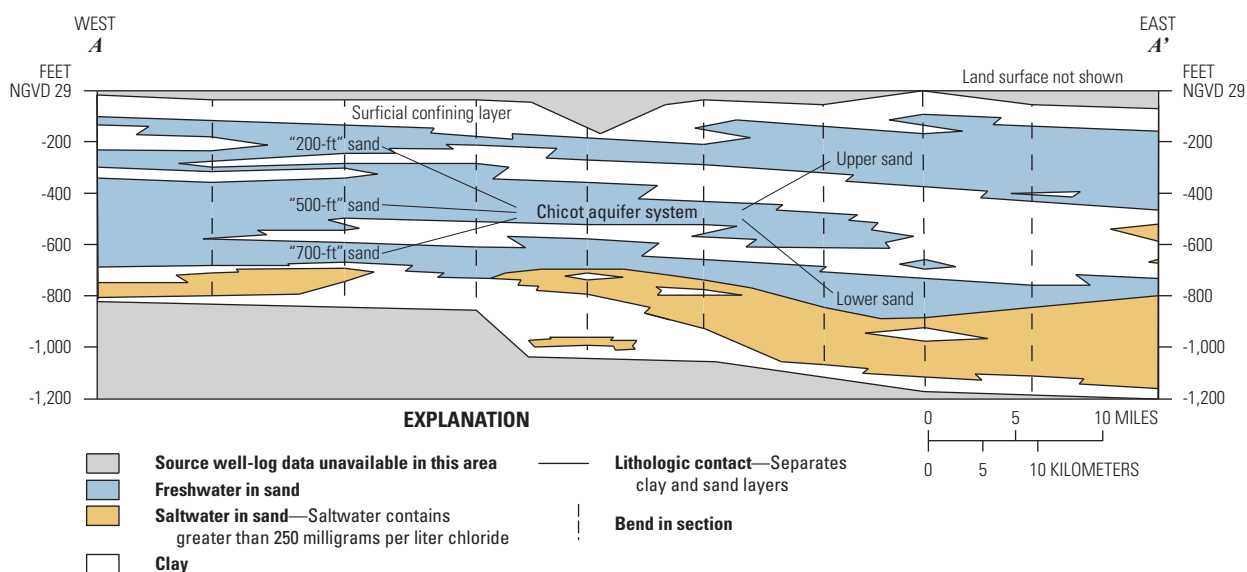


Figure 3. Generalized west-to-east hydrogeologic section A–A' through Calcasieu Parish, Louisiana (modified from Nyman, 1984). Trace of section shown on figure 1.

Table 3. Active registered wells in the Chicot aquifer system in Calcasieu Parish in 2015 (Louisiana Department of Natural Resources, written commun., 2015).

	Shallow sand	"200-foot" and upper sands	"500-foot" sand	"700-foot" and lower sands	Undifferentiated sand
Domestic	276	2,985	935	15	20
Industrial	5	35	121	12	4
Irrigation	17	120	93	16	7
Public supply	7	142	120	13	4
Power generation	0	0	6	0	0
Total	305	3,282	1,275	56	35

Well depth range (feet below land surface)	13–305	18–590	130–740	445–849	70–460
Yield range (gallons per minute)	2–50	4–5,471	5–5,000	20–4,700	30–4,000

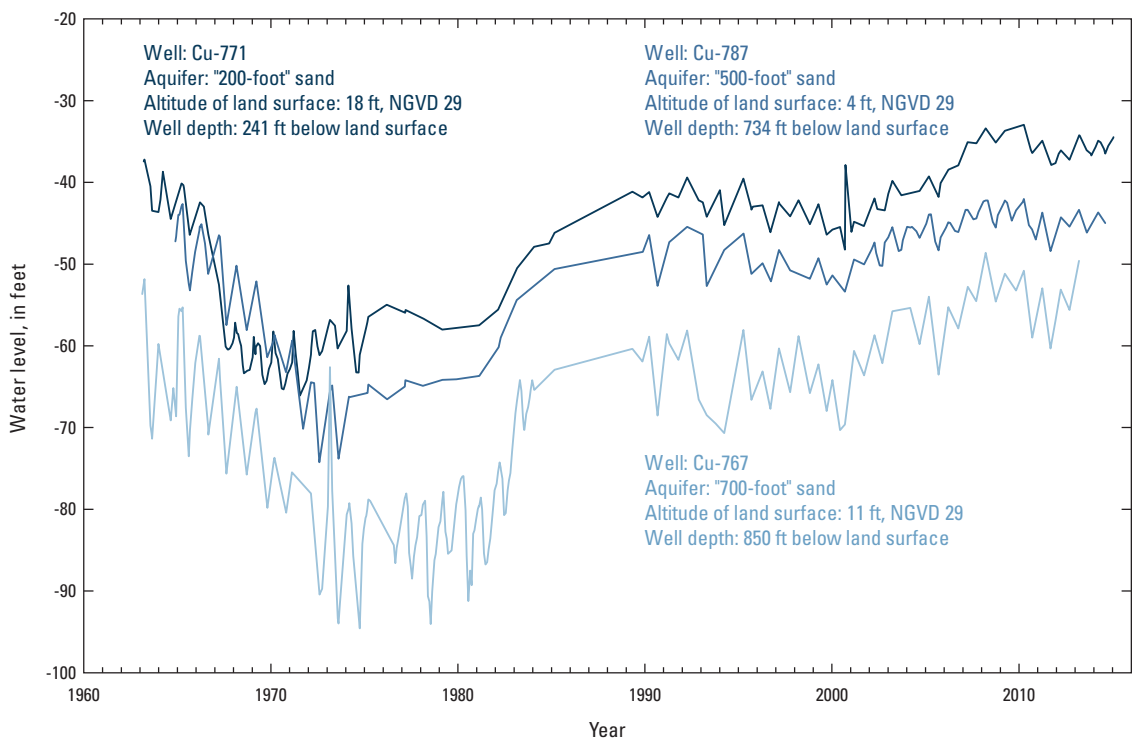


Figure 4. Water levels in wells Cu-771, Cu-787, and Cu-767 screened in the "200-foot" sand, "500-foot" sand and "700-foot" sand of the Chicot aquifer system in Calcasieu Parish, Louisiana (see fig. 1 for well locations; U.S. Geological Survey, 2016a). Land surface and water levels are in feet (ft) relative to the National Geodetic Vertical Datum of 1929 (NGVD 29).

"500-foot" sand, saltwater is present along much of the southern parish boundary, in the southeastern corner of the parish, and in three small isolated areas at or near industrial facilities between Lake Charles and Sulphur. At the base of the "700-foot" sand and in the lower sand, saltwater is present in the southern two-thirds of the parish. The "700-foot" sand contains only saltwater along most of the southern parish boundary (Harder, 1960; Nyman, 1989).

Surface-Water Resources

Surface-water resources in Calcasieu Parish are available in two regional drainage basins: the Calcasieu-Mermentau Basin (Hydrologic Unit Code [HUC] 080802), which covers the majority of the parish, and the Sabine Basin (HUC 120100), which is present along the Sabine River on the western side of the parish (U.S. Geological Survey, 2016b). In 2010, about 136.7 Mgal/d of surface water were withdrawn in Calcasieu Parish for public supply, industry, power generation, livestock, rice irrigation, and aquaculture use (table 2). Over 95 percent of surface-water withdrawals came from

the Calcasieu River (76.22 Mgal/d) and Sabine River Diversion System (54.07 Mgal/d) (table 2).

Calcasieu-Mermentau Basin

The Calcasieu-Mermentau Basin is subdivided into six subbasins, four of which are present in Calcasieu Parish. These subbasins are the West Fork Calcasieu (HUC 08080205), Upper Calcasieu (HUC 08080203), Lower Calcasieu (HUC 08080206), and Mermentau (HUC 08080202) (fig. 1).

The West Fork Calcasieu and Upper Calcasieu subbasins cover most of the northern half of the parish and drain south into the Lower Calcasieu subbasin, which extends to and drains southward into the Gulf of Mexico. The West Fork Calcasieu subbasin is drained by the Houston River, West Fork Calcasieu River, Indian Bayou, and many other small streams. The Houston River and Indian Bayou are tributaries of West Fork Calcasieu River, which flows into the Calcasieu River just upstream of Lake Charles. The Upper Calcasieu

Table 4. Summary of selected water-quality characteristics of freshwater in the Chicot aquifer system in Calcasieu Parish, Louisiana (U.S. Geological Survey, 2016a).

[Values are in milligrams per liter, except as noted. °C, degrees Celsius; PCU, platinum cobalt unit; µS/cm, microsiemen per centimeter; SU, standard unit; CaCO₃, calcium carbonate; µg/L, microgram per liter; NA, not applicable; SMCL, Secondary Maximum Contaminant Level established by the U.S. Environmental Protection Agency (2016)]

	Temper- ature (°C)	Color, (PCU)	Specific conductance, field (µS/cm at 25 °C)	pH, field (SU)	Hardness (as CaCO ₃)	Chloride, filtered (as Cl)	Iron, filtered (µg/L as Fe)	Manga- nese, filtered (µg/L as Mn)	Dissolved solids, filtered
“200-foot” sand of the Lake Charles area, 1940–2009 (111 wells)									
Median	22.0	1	483	7.5	110	32	230	140	280
10th percentile	20.3	0	364	6.9	66	16	30	60	232
90th percentile	23.3	10	1,090	7.9	200	120	2,800	450	509
Number of samples	79	28	95	68	73	106	46	48	63
Percentage of samples that do not exceed SMCLs	NA	93	NA	93	NA	100	59	6	86
“500-foot” sand of the Lake Charles area, 1940–2006 (239 wells)									
Median	23.5	5	404	7.2	110	34	1,000	350	258
10th percentile	22.0	0	301	6.8	80	22	180	240	214
90th percentile	25.0	20	677	7.6	140	98	2,200	480	436
Number of samples	127	99	188	143	155	237	97	91	104
Percentage of samples that do not exceed SMCLs	NA	87	NA	99	NA	100	19	1	92
“700-foot” sand of the Lake Charles area, 1939–95 (63 wells)									
Median	24.0	5	548	7.4	100	68	920	390	332
10th percentile	22.0	0	341	6.7	66	26	260	160	263
90th percentile	25.5	36	952	8.2	140	200	2,100	500	558
Number of samples	32	29	49	40	46	62	15	20	30
Percentage of samples that do not exceed SMCLs	NA	72	NA	92	NA	100	13	0	83
SMCLs									
	NA	15	NA	6.5–8.5	NA	250	300	50	500

subbasin is drained by the Calcasieu River whose tributaries include Bayou Serpent and many other small streams. The annual average discharge upstream of Calcasieu Parish for the Calcasieu River near Kinder (site number 08015500) (fig. 1) during 1922–2014 was 2,524 cubic feet per second (ft³/s) (U.S. Geological Survey, 2016a) from a drainage area of 1,700 square miles (mi²). The Lower Calcasieu subbasin in Calcasieu Parish contains the Calcasieu River, Bayou Choupique, the Gulf Intracoastal Waterway, and many other small streams. Multiple lakes are found along the Calcasieu River in Calcasieu Parish.

The Mermentau subbasin is located in the southeastern corner of the parish and is drained by Bayou Lacassine and other small streams.

Sabine Basin

The Sabine Basin contains only the Lower Sabine subbasin in Calcasieu Parish (HUC 12010005) and is drained by the Sabine River. The Sabine River drains a strip of land along the western border of

the parish and is connected to the interior of Calcasieu Parish by canals. In the north-central part of the parish, the Sabine River Diversion System conveys water by way of canal from the Sabine River eastward to several industries located near Westlake and Sulphur. The system also supplies water for municipal use and irrigation (Sabine River Authority, 2007). In the southern part of the parish, the Gulf Intracoastal Waterway runs roughly east-west from the Texas border, across the Calcasieu River just south of Moss Lake, then southeastward into Cameron Parish. The annual average discharge of the Sabine River near Ruliff, Tex. (site number 08030500), (fig. 1) during 1961–2015 was 7,626 ft³/s from a drainage area of about 9,330 mi² (U.S. Geological Survey, 2016a).

Surface-Water Quality

Water samples collected from the Calcasieu River near Lake Charles (site number 08015900) during 1968–78 and from the Sabine River near Ruliff, Tex., during 1967–2000 have median

hardness values in the soft range (table 5). Over 80 percent of samples did not exceed the SMCL for iron concentrations, and median pH values were also within the SMCLs. Dissolved-oxygen concentrations were generally greater than 5 mg/L, which is considered the minimum value for a diverse population of fresh, warmwater biota, including sport fish (Louisiana Department of Environmental Quality, 2008).

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Table 5. Summary of selected water-quality characteristics for the Calcasieu and Sabine Rivers, Calcasieu Parish, Louisiana (U.S. Geological Survey, 2016a).

[Values are in milligrams per liter, except as noted. $\mu\text{S}/\text{cm}$, microsiemen per centimeter; $^{\circ}\text{C}$, degrees Celsius; SU, standard unit; CaCO_3 , calcium carbonate; $\mu\text{g}/\text{L}$, microgram per liter; SMCL, Secondary Maximum Contaminant Level established by the U.S. Environmental Protection Agency (2016); NA, not applicable]

	Specific conductance, field ($\mu\text{S}/\text{cm}$ at 25 $^{\circ}\text{C}$)	Oxygen, dissolved	pH, field (SU)	Hard- ness (as CaCO_3)	Calcium, filtered (as Ca)	Magne- sium, filtered (as Mg)	Sodium, filtered (as Na)	Chloride, filtered (as Cl)	Sulfate, filtered (as SO_4)	Iron, filtered ($\mu\text{g}/\text{L}$ as Fe)
Calcasieu River near Lake Charles, 1968–78 ¹										
Median	98	7.4	6.7	18	4.2	1.7	12	18	6.0	140
10th percentile	43	5.4	5.8	10	2.5	0.8	4.3	5.1	3.7	80
90th percentile	3,360	10.0	7.2	330	26	65	520	980	130	360
Number of samples	49	48	49	49	49	49	49	49	49	15
Percentage of samples that do not exceed SMCLs	NA	NA	69	NA	NA	NA	NA	86	94	87
Sabine River near Ruliff, Texas 1967–2000 ²										
Median	142	7.8	6.8	29	7.4	2.4	15	18	12	150
10th percentile	92	6.4	6.2	18	4.9	1.3	9.2	11	7.2	70
90th percentile	197	10.2	7.2	38	10	3.3	21	27	19	360
Number of samples	538	190	302	291	291	291	213	520	519	106
Percentage of samples that do not exceed SMCLs	NA	NA	80	NA	NA	NA	NA	100	100	87
SMCLs										
	NA	NA	6.5–8.5	NA	NA	NA	NA	250	250	300

¹Site number 08015900 (see fig. 1).

²Site number 08030500 (see fig. 1).